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Context Effects on Ambiguous Idiom Comprehension in Older and Younger Adults

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CONTEXT EFFECTS ON AMBIGUOUS IDIOM COMPREHENSION IN OLDER AND YOUNGER ADULTS

by

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ABSTRACT

The focus of the current study was on idiom comprehension in younger and older adults. Due to inconsistent results in previous studies, it is unclear whether older adults may have problems understanding idioms. For the current study, I used a sentence-to-word matching task presented on an iPad with software that recorded participants' response time and accuracy. Participants also completed a familiarity task where they rated idioms on how frequently these phrases were encountered. I predicted that older adults would have more difficulty comprehending idioms because of the context in which the idioms were embedded and the timed nature of the task. I also predicted that both age groups would rate the idioms as highly familiar because we purposefully selected these types of expressions. With respect to the sentence-to-word matching task, results showed that although older adults were slower overall, both younger and older adults showed faster response times and greater accuracy for idiomatic targets following idiomatically-biased contexts than for literal targets following literally-biased contexts. With respect to the familiarity ratings task, results showed that both age groups were very familiar with the idioms. These findings suggest that older adults are able to successfully use context to understand familiar ambiguous idioms and that they do not have difficulty comprehending idioms in a cognitively demanding timed task.

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I. INTRODUCTION

Idioms are among the most common forms of language and are frequently used in English (Hamblin & Gibbs, 1999). Idioms are distinct from other types of figurative language, such as similes, metaphors, and proverbs. Similes are phrases that compare an object or idea using "like" or "as", as in the phrase *he is as strong as an ox* (Glucksberg & McGlone, 2000). Metaphors are figures of speech that create a comparison between two things that are not necessarily alike, however do have a similar characteristic, such as *The second grade classroom was a zoo* (Glucksberg & McGlone, 2000). Finally, proverbs are short, abstract sayings that express messages about society, as in *Early to bed and early to rise, makes a man healthy, wealthy and wise* (Ahmed & Miller, 2015). In contrast, idioms are often described as "fixed expressions", or phrases where the meaning cannot be derived from the individual words of the expression (Abel, 2003).

There are many different types of idioms, however for this study, my focus is on ambiguous idioms. Ambiguous idioms have two distinct interpretations: a figurative and a literal one. This can be demonstrated with the idiom *a slap in the face*. You can literally slap someone in the face, or you can figuratively be hurt by one's actions. The goal of the present study is to investigate how younger and older adults use context to resolve ambiguous idioms. Some previous studies have found that older adults are able to understand idioms in a comparable manner to younger adults (Qualls & Harris, 2003), while other studies have found that older adults have difficulty inhibiting the figurative meaning of idioms which also have a possible literal interpretation (Westbury & Titone, 2011). Due to the inconsistent results in terms of older adults' ability to understand

idioms, it is unclear if older adults will be able to effectively use context to understand idioms which also have a possible literal interpretation.

Idiom Comprehension Models

Many models have been proposed to explain how healthy young adults access the meanings of idioms. Some research shows that the literal meaning of an idiom is first accessed before the figurative meaning can be accessed, while other research argues that the figurative meaning can be accessed directly. In general, idiom comprehension models can be grouped into three categories: compositional, noncompositional, and hybrid models.

Noncompositional Models

Noncompositional models follow the concept that idioms are stored directly in the lexicon, meaning that they are stored either in a special list, or with other words (Bobrow & Bell, 1973). Three noncompositional models will be discussed in this section: the *literal processing hypothesis*, the *lexical representation hypothesis,* and the *direct access hypothesis*. According to Bobrow and Bell's (1973) *literal processing hypothesis*, idioms are fixed expressions whose figurative meaning is stored in a separate list, and accessed when a person goes into an idiom comprehension mode. Unlike other models, the idiomatic meaning is only retrieved after the literal analysis of the idiom string has failed. Initial support for the *literal processing hypothesis* came from Bobrow and Bell's early study focused on whether priming subjects with either literal or figurative sentences caused them to process ambiguous idioms literally or figuratively. Subjects were given sets of figurative or literal sentences followed by an ambiguous idiom. After reading

these sentences, they were asked to report whether they interpreted a sentence containing an ambiguous idiom (e.g., *John was in hot water*) literally or idiomatically. The results demonstrated that participants perceived the idiomatic meaning when they had just read idiomatic sentences and the literal meaning when they had just read literal sentences. Bobrow and Bell concluded that individuals must go into a special mode to process idioms and that this mode can be overridden if individuals are presented with literal sentences beforehand, which apparently biases them toward literal processing instead.

Swinney and Cutler (1979) argued that computation of the literal and the idiomatic meanings are completed simultaneously. According to their *lexical representation hypothesis*, access of the individual words of the idiom takes place at the same time as access of the whole phrase. In support of this theory, Swinney and Cutler (1979) used a phrase classification task where the participants were presented with either idiomatic phrases (e.g., *kick the bucket*) or literal phrases (e.g., *lift the bucket*) and had to determine if the phrase was meaningful in English. Results showed that idioms were determined to be acceptable much faster than other English phrases. In other words, it took much less time to comprehend the idiom string than other forms of English, which supports the theory that idiom strings are stored in the lexicon just like any other word. Moreover, it appears that access to the idiomatic and literal interpretations occurs simultaneously.

The *direct access hypothesis* (Gibbs, 1980) suggests that the literal interpretation of an idiom does not need to be computed. Given appropriate context, the intended meaning of the idiom can be understood directly (Gibbs, 1980, 1985). To test this theory, Gibbs (1980) conducted a study to investigate comprehension of ambiguous idioms.

Participants were given 16 short stories to read (8 idiomatic, 8 literal), one line at a time, and they were timed on how long it took them to read each story. The last line of each story contained an ambiguous idiom (e.g., *He is singing a different tune* could mean he is not singing the same song, or he has now changed his mind). After reading each story, participants were asked to summarize what they had just read. It took the subjects much less time to summarize the idiomatic stories than it did the literal ones. This data provides evidence for the idea that subjects do not interpret phrases literally before retrieving the idiomatic meaning. Instead, the idiomatic meaning of idioms can be accessed directly after encountering it, given appropriate context.

Compositional Models

Compositional models argue that idioms are understood by integrating the meanings of the individual words of the idiom to form the figurative interpretation. An example of a compositional model is the *configuration hypothesis*, which states that idioms are configurations of words that undergo a linguistic analysis (Cacciari & Tabossi, 1988). Thus, each phrase is processed literally until a key word is read; then the idiomatic meaning is activated (Cacciari & Tabossi, 1988). In Cacciari and Tabossi's study, they used opaque idioms, which only have a figurative meaning. However, these phrases could be computed literally until the reader reaches the last word. They presented the idiom string in context (e.g. *After the excellent performance, the tennis player was in seventh heaven)*, so the participants could use the surrounding information to arrive at a literal or figurative interpretation of the given idiom. After reading the idiom, the participant had three options to choose from: *saint*, which was semantically related to heaven, *happy,* which was semantically related to the meaning of the idiom, and an

unrelated control, *umbrella*. The results of this experiment show that the idiomatic target was chosen the majority of the time among participants.

Hybrid Models

Finally, hybrid models, which are a combination of the compositional and noncompositional models, propose that the literal interpretation is initially activated, then activation of the figurative meaning will increase over time depending on certain linguistic constraints, such as how familiar or predictable the idiomatic phrase is. One such proposal is referred to as the *constraint-based hypothesis* (Libben & Titone, 2008). In Libben and Titone's study (2008), participants analyzed idiomatic, literal, and nonsense sentences and determined if they were meaningful in English. The results showed that the responses to the idiom sentences were significantly slower than the literal sentences. Yet the response times to nonsense sentences were slower compared to idioms, and were more accurate than idioms. This data aligns with the idea that individuals process idioms slower than other forms of language, because the literal meaning must first be activated before the idiomatic meaning can be retrieved. In another task, Libben and Titone (2008) presented participants with sentences one word at a time at a fixed rate. Again, the participants then selected yes or no in regard to meaningfulness. The results showed that the responses to the idiom sentences were significantly slower than the literal or nonsense sentences. This data again provides support for the *constraint-based hypothesis* which states that the literal interpretation is initially activated, and access to the idiomatic meaning increases over time.

Factors Related to Idiom Comprehension

Several factors such as how familiar someone is with an idiom and the context in which the idiom is embedded contribute to the ability to understand idioms. Familiarity is the frequency with which someone has encountered a given idiom. Context helps to provide individuals with the information needed to decide whether the idiom should be interpreted literally or figuratively (Holsinger, 2013).

Cronk, Lima, and Schweigert (1993) investigated the interaction of familiarity and context during idiom comprehension. It has previously been shown that highly familiar idioms are associated with faster reading times and that if the context is biased toward the figurative meaning, then the figurative meaning is more likely to be retrieved. In Cronk, Lima and Schweigert's (1993) study, some idioms were semantically embedded in a context that led the reader toward the idiomatic meaning (*e.g., The teacher was upset because her class was out of hand)*. Other idioms were embedded in literal sentences that were supposed to lead the individual to the literal meaning (*e.g., Fishermen used a gaff to take their fish out of water)*. For less familiar idioms, the individuals took longer to read the figurative sentence therefore, they also took longer to comprehend the sentence. This finding tells us that the more familiar an individual is with a given idiom, they can read and comprehend the idiom faster than if they are less familiar with the expression.

Holsinger (2013) conducted a study in which he looked at whether the context of the sentence surrounding the idiom biased the individual to interpret the idiom as idiomatic or literal. Sentences were either idiomatically biased (e.g., *Swimming with sharks is a dangerous and unpredictable profession. As a result of the shark attack,*

several oceanographers kicked the bucket last Thursday evening.) or literally biased (e.g., *John spent all day filling things with cement as a nasty prank. Several people broke their toes when they kicked the bucket last Thursday evening and may sue*.). After hearing a sentence, participants were presented with four words in different corners of the screen: a literal word, an idiomatic word, and two distractor words. An eye-tracker was used to monitor which word the participant looked at first and longest after hearing either a literally- or idiomatically-biased sentence. Results showed that after hearing the literally-biased sentences, the participants looked at the literal words the longest. The participants also looked at the idiomatically related word for the longest period of time after hearing the idiomatically-biased sentences. These results show that context plays a large role in determining which meaning of an idiom is understood.

Based on the above studies, context and familiarity both aid in the interpretation of idioms. Previous research demonstrates the importance of incorporating these elements into the current study because if a participant is unfamiliar with the presented idiom, then this may impact their ability to correctly interpret the phrase. Context also helps to determine whether the idiom should be interpreted literally or figuratively. Therefore, it is also critical to make sure that enough context is provided for individuals to be able to identify if ambiguous idioms are to be interpreted literally or figuratively.

Figurative Language Skills of Older Adults

Older adults may have a harder time processing idioms due to factors that are attributed to aging. Cognitive decline due to physiological changes can start being noticed as early as age 50 in healthy older adults (Kaufman, 2007). Aging is also associated with declines in working memory, executive control, and processing speed

(Qualls & Harris, 2001). Specifically, a decline in working memory due to aging has been linked to deficits in a variety of language comprehension tasks including reading comprehension, and the understanding of syntactically complex sentences (Qualls & Harris, 2001). It has also been found that working memory is responsible for the integration of information, and helps to decipher ambiguity (Qualls & Harris, 2001). Therefore, age-related declines in these areas may impact the comprehension of figuratively language, specifically idioms.

It is of interest to study figurative language comprehension in older adults, particularly idioms, because some older adults have problems with understanding other types of figurative language such as metaphor. (Hung & Nippold, 2014). However, compared to other types of figurative language, very few studies have been conducted on older adults' idiom comprehension abilities, especially as related to using context to understand ambiguous idioms. Westbury and Titone (2011) conducted a study to investigate literality judgements in younger and older adults to see how these individuals comprehend ambiguous idioms. Older adults are of interest in this study because they can have declines in certain linguistic areas that may prevent them from correctly identifying the figurative meaning of an idiom (Westbury & Titone, 2011). In this study, groups of young and old adults were shown an idiom outside of a disambiguating context and were asked to respond as to whether the phrase was literally true or not. The data showed that older adults had a harder time identifying the ambiguity of the idiom, however they did have faster reaction times than younger adults when rejecting literal idioms. However, the older adults were slower to identify idioms that had more than one meaning and their accuracy was worse than that of the younger adults. Therefore, older adults seem to have

a more difficult time comprehending figurative language. This conclusion is derived from their slow reaction time, and difficulty in identifying the correct meaning of an idiom when presented with more than one option.

In another study, Qualls and Harris (2003) investigated older adults' ability to comprehend figurative language, specifically idioms, and whether there is a relationship with reading ability. Groups of younger and older adults were given a booklet, and on each page was an idiom (e.g., *keep up one's end*) and four multiple choice options: the correct figurative response *(*e.g., *to do your share of the work)*, a correct literal interpretation *(*e.g., *to wait for others to do something*), an incorrect opposite foil (e.g., *to carry a weight around*), and an incorrect elaborated foil (e.g., *to prop up the right side*). Younger adults choose the correct answer 78% of the time, whereas the older adults choose the correct response 75% of the time. The study suggests that idiom comprehension across the lifespan stays intact.

Coane et al. (2014) designed a memory task to test idiom processing in relation to aging. The participants were shown 40 phrases: 20 idioms (e.g., *kick the bucket*) and 20 literal equivalents (e.g., *kick the pail*). Each phrase appeared for 4 seconds; after the phrases were shown the participants played a game of Sudoku to serve as an unrelated filler task. The phrases would then reappear on the screen; however, the subjects were sometimes presented with the alternative form of the phrase that they studied. For example, if they studied the literal equivalent of that idiom, they would be presented with the idiomatic form, and if they studied the idiomatic phrase, they would receive the literal equivalent. If the participant selected the idiomatic phrase when the literal equivalent was displayed, then it would indicate that the literal equivalent activates the idiomatic

meaning stored in the lexicon. The results showed that participants selected the idiomatic phrase after being shown the literal phrase twice as often as individuals who saw the idiomatic phrase, and selected the literal equivalent. The authors conclude that the idiomatic meaning of idioms can be activated by reading phrases that share a literal meaning. After carefully examining the data, age was not a significant factor.

Finally, in another study, Hung and Nippold (2014) were interested in age-related changes in idiom processing. They recruited adults between the ages of 20-29, 40-49, 60-69, and 80-89. Twenty idioms were presented to participants out-of-context (*e.g., blow off steam*) in three different tasks. The first task was a familiarity task in which the participants rated how familiar they were with the idioms. Participants also completed an explanation task in which they received a booklet with the same 20 idioms and were asked to explain the idiom, then describe it in a situation (e.g., *What does it mean to get in someone's hair?)*. Finally, subjects participated in a multiple-choice comprehension task where they would receive the out-of-context idiom, and were asked to select the meaning of the idiom form four different responses (e.g., *What does it mean to sing a different tune? (A) To change one's mind, (B) To act selfishly, (C) To request special treatment,* or *(D) To argue with others)*. Results showed that the 20 year olds performed slightly worse than the 60 year olds on the familiarity task, and the explanation task, however, this was the only statistically significant difference. This study demonstrates that aging does not have a large impact on idiom comprehension.

The majority of previous studies have found that aging does not impact idiom comprehension. However, there are several factors to consider. Many previous studies used simple tasks that were untimed. Therefore, a participant could take as long as they

needed to provide the correct answer. Some studies also expose the participant to the idiom before they take part in the experimental task. Finally, many of the studies do not surround the idiom with context. These methods are very different from my study, which uses a more cognitively demanding task due to the context in which the idioms are embedded in, and timed responses.

Overview of the Current Study

The goal of the current study was to investigate how aging impacts idiom comprehension in context. I sought to answer two research questions: How does aging impact the ability to understand ambiguous idioms? and Are older adults able to effectively use context during a cognitively demanding task? In a sentence-to-word matching task, participants were asked to listen to sentences biased toward either a literal or a idiomatic interpretation. After the participants heard the sentences, four words appeared on an iPad screen. Participants then chose which word best suited the meaning of the sentence. I predicted that for individuals who were able to use the context effectively, they would only activate contextually-appropriate meanings. I also predicted that older adults would have more difficulty comprehending idioms because of the context in which the idioms were embedded and the timed nature of the sentence-to-word matching task. In a second experiment, a familiarity ratings task, participants were asked to rate how familiar they were with the phrases that they had previously heard in the sentence-to-word matching task. Participants were presented with an idiom and asked to choose on a scale of 1-5, where 1 is never and 5 is frequently, how often they had encountered each phrase. I predicted that highly familiar idioms would receive higher

ratings, and that individuals would be more likely to select the figurative meaning for highly familiar idioms in the sentence-to-word matching task.

II. METHODS

Participants

I initially recruited 26 healthy younger adults (average age of 22) and 10 healthy older adults (average age of 68), although 6 participants (5 younger adults and 1 older adult) were eventually excluded due to high error rates in the sentence-to-word matching task (see results below). The younger adults were recruited through email, and the older adults were recruited through a lab database. Young and older adults were native monolingual English speakers with no reported history of speech, language or hearing problems, any neurological disease, mental illness, or major health problems. Both groups had normal vision and hearing, as tested before participating in the study. All participants were dominantly right handed according to the Edinburgh Handedness Inventory (Oldfield, 1971). The average education level of the younger adults was 16.05 years and the average education level for the older adults was 18.44 years. The Institutional Review Board (IRB) approved this study, and informed consent was received from all participants. Demographic information for younger and older adults is presented in Tables 1 and 2, respectively.

Table 1. Younger adults' demographic information.

Participant	Age	Gender	Education
1	22	M	16
2	20	F	14
3	22	F	17
5	21	M	15
7	23	F	16
8	24	F	17
9	21	F	16
11	20	F	16
12	22	F	15
13	21	F	15
14	22	M	16
15	20	M	16
16	19	F	16
18	22	F	16
19	21	F	16
21	21	F	16
22	22	F	16
23	21	F	16
24	24	M	16
25	21	F	16
26	21	F	16

Table 2. Older adults' demographic information.

Participant	Age	Gender	Education
1	64	F	16
2	65	F	16
3	67	F	18
4	73	M	18
5	66	F	16
6	60	M	18
7	71	F	23
9	62	F	18
10	65	F	18

Materials

A total of 80 familiar ambiguous idioms were used in the current study. These idioms were selected from a large database of 200 ambiguous idioms, all of which were previously rated on familiarity, final word predictability, literal plausibility, decomposability and transparency. Half of the idioms were embedded in a sentence biased toward the idiomatic interpretation of the phrase (e.g., *He made a comment about his friend's marital problems that was below the belt.)* and the other half in a sentence biased toward the literal interpretation (e.g., *In an attempt to stay warm, she added fuel to the fire.)*. All sentences were independently rated on how biased they were toward the intended idiomatic or literal interpretation (see Grindrod & Raizen, in press). In a previous study, participants were asked to rate on a scale of 1-5 the degree to which each sentence was biased toward either an idiomatic interpretation (1) or literal interpretation (5) with brief definitions listed at the ends of the scale to clarify the intended meanings. For the final 40 idiomatically-biased sentences selected, the mean rating was 1.19. For the final 40 literally-biased sentences selected, the mean rating was 4.55. These ratings confirm that the sentences strongly biased participants toward the contextually-appropriate interpretation.

For the sentence-to-word matching task, participants were asked to select which of four words was most related to the meaning of the sentence. Of these four words, one was related to the idiomatic interpretation, another was related to the literal interpretation, and the other two options were unrelated words matched to the first two words in terms of mean length in letters and mean log frequency (Brysbaert & New, 2009; see Figure 1). Target words related to the figurative meaning were chosen by selecting a word from

definitions provided in the Longman Pocket Idioms Dictionary (Lee, 2000). Target words related to the literal meaning were strong semantic associates of one of the content words of the idiom, not necessarily the final word, with association strength based on the University of South Florida association norms (Nelson, McEvoy & Schreiber, 1998).

For the familiarity ratings task, 80 of the idioms were the highly familiar idioms from the sentence-to-word matching task, and the other 80 phrases were idioms rated as having low familiarity according to previous studies. To construct these sentences, I took the idiom and added a pronoun without any additional context (e.g., *She added fuel to the fire;* see Figure 2*)*.

Procedure

For both of the experimental tasks described below, I used software called Paradigm to record participants' response time and accuracy. For the sentence-to-word matching task, the iPad was initially placed in front of the participants, approximately 6 inches away, and they were told to place an Apple Pencil on a fixation cross located in the center of the screen. The Pencil works as a stylus so the participant does not have to use their finger. The pencil was used to reduce response time variability and to ensure that the entire iPad screen was clearly visible to participants throughout the experiment. If participants had used their finger to respond, which is more typical with an iPad, they may have blocked part of the screen or not placed their finger as precisely to respond. A small colored dot was placed on the Pencil so that all participants knew where to hold it. After the initial setup, participants then heard an idiom embedded in a sentence biased toward either the idiomatic or literal interpretation. After the sentence ended, four words appeared, one in each corner of the iPad screen, and participants were asked to select

which word was most related to the meaning of the sentence (see Figure 1 for an example). The participant had five seconds to respond after the four words appeared. After they responded, there was a brief delay for the participant to place the Pencil back on the fixation cross before the next sentence played. Participants were given five practice trials to acquaint themselves with the task. During the practice session, the participants were also shown how to hold the pencil in relation to the iPad. The session lasted 30 minutes.

Figure 1. Sentence-to-Word Matching Task.

Participants were also given a familiarity ratings task to verify that they knew all of the idioms. Participants were instructed to read each sentence, and rate how frequently they had seen, heard, or used this phrase using a scale of one to five (one being never, and five being very frequently; see Figure 2 for an example). This task was completed on a laptop. The laptop was placed directly in front of the subject, and they provided their response via a mouse click on the number that best corresponded to their level of familiarity. The participants had five seconds to respond. The subjects had five practice trials to become acquainted with the task. This session lasted 15 minutes.

Figure 2. Familiarity Ratings Task.

III. RESULTS

Of the original 36 participants tested, 6 were excluded due to high error rates (5 younger adults and 1 older adult). Therefore, 21 younger adults and 9 older adults are included in the analyses reported below. For the sentence-to-word matching task, trials that were responded to incorrectly (mean younger adults = 12.56%; mean older adults = 8.33%) or where participants did not respond before the 5000 millisecond (ms) time limit elapsed (< 2% of all trials) were excluded. In addition, any trials with response times (RTs) exceeding 3000 ms were excluded (mean younger adults = 4.88%; mean older adults = 10.14%). Average RTs were then calculated for each participant per condition. RTs that fell more than 2 standard deviations above and below each participant's mean per condition were considered outliers and removed from the data analysis (mean younger adults = 2.26%; mean older adults = 3.19%).

Sentence-to-word Matching Task

Log-transformed mean response times (ms; correct responses only) and mean accuracy (percent correct) were analyzed using a 2 × 2 repeated-measures ANOVA with the within-subject factor of Context (Idiomatic vs. Literal) and between-subject factor of Group (Young vs. Old). For the RT analysis, results showed a main effect of Group [$F(1, 28) = 6.03$, $p < .05$, $\eta_p^2 = 0.18$], indicating that younger adults overall produced faster response times than older adults. There was also a main effect of Context [$F(1, 28) = 120.34$, $p < .0001$, $\eta_p^2 = 0.81$], indicating that across both groups, responses to idiomatic targets following idiomatically-biased contexts were faster than responses to literal

targets following literally-biased contexts. Finally, there was a significant interaction of Group × Context [$F(1, 28) = 6.39$, $p < .05$, $\eta_p^2 = 0.19$], demonstrating overall slower responses by older adults in both contexts, but the same pattern as the younger adults, that is faster responses to idiomatic targets following idiomatically-biased contexts than to literal targets following literally-biased contexts. Specifically, younger adults responded more quickly to idiomatic targets following idiomatically-biased contexts (1644 ms) than to literal targets following literally-biased contexts (1810 ms), and older adults responded faster to idiomatic targets following idiomatically-biased contexts (1848 ms) than to literal targets following literally-biased contexts (2151 ms). Mean RTs for idiomatic and literal targets in their respective biasing contexts are presented for younger and older adults in Figures 3 and 4, respectively.

Figure 3. Younger adults' reaction time data (in ms) for the sentence-to-word matching task.

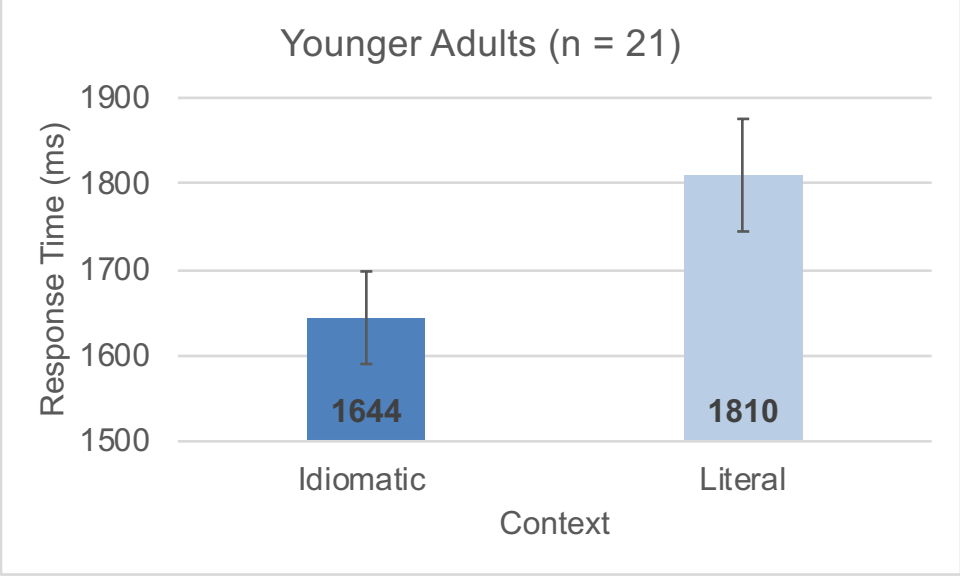
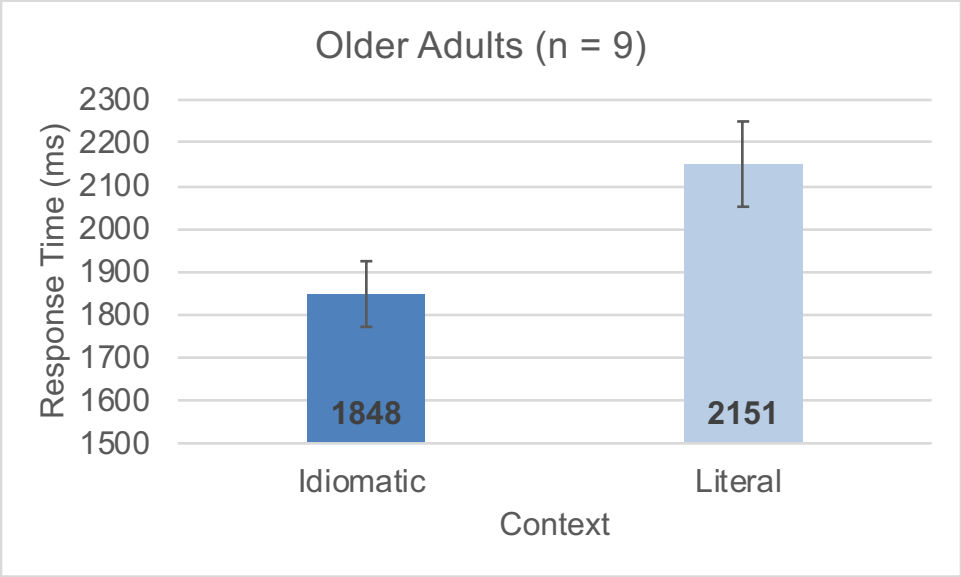


Figure 4. Older adults' reaction time data (in ms) for the sentence-to-word matching task.



For the accuracy analysis, results showed a significant main effect of Context [$F(1, 28) = 25.64$, $p < .0001$, $\eta_p^2 = 0.48$], demonstrating that across both groups, responses to idiomatic targets following idiomatically-biased contexts were more accurate than responses to literal targets following literally-biased contexts. Although no other main effects or interactions were significant, it does appear that older adults were somewhat more accurate (98% for idiomatic targets following idiomatically-biased contexts and 86% for literal targets following literally-biased contexts) than the younger adults (93% for idiomatic targets following idiomatically-biased contexts and 82% for literal targets following literally-biased contexts). Both groups had the most number of errors when presented with a literally-biased context. A large number of errors occurred because the participants were selecting the idiomatic target word after a literally-biased sentence. Mean accuracy for idiomatic and literal targets in their respective biasing contexts are presented for younger and older adults in Figures 5 and 6, respectively.

Individual mean response time and accuracy data by condition for younger and older adults is presented in Tables 3 and 4, respectively.

Figure 5. Accuracy (% correct) for younger adults in the sentence-to-word matching task.

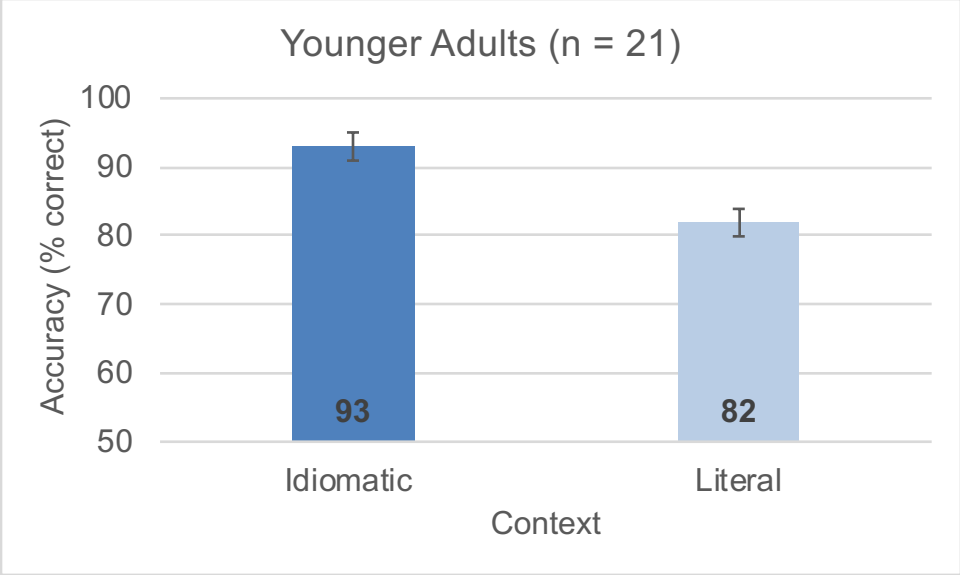


Figure 6. Accuracy (% correct) for older adults in the sentence-to-word matching task.

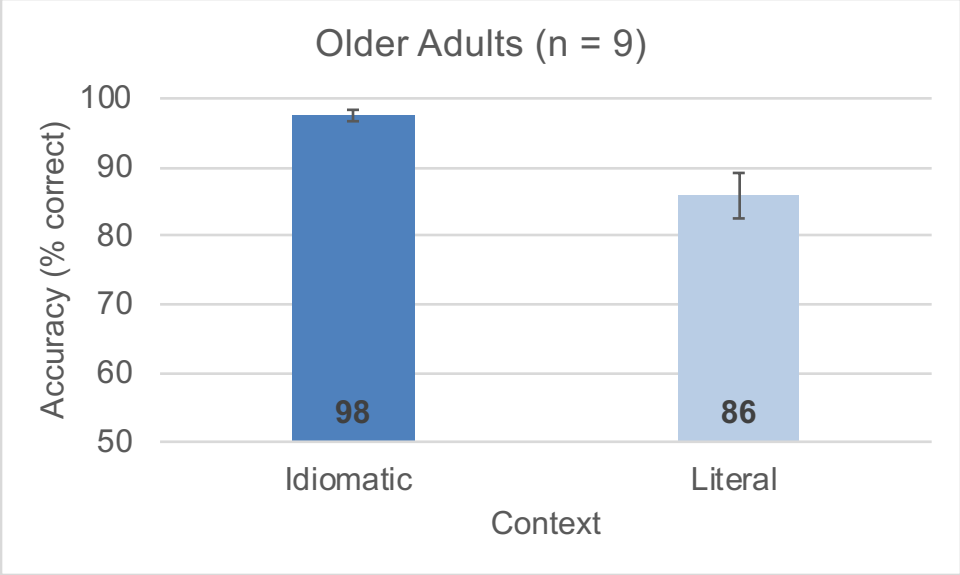


Table 3. Younger adults' individual mean response time and accuracy data for the sentence-to-word matching task.

Participant	Idiomatically-biased Context Mean RT (ms)	Literally-biased Context Mean RT (ms)	Idiomatically-biased Context Mean Accuracy (% correct)	Literally-biased Context Mean Accuracy (% correct)
1	2073.02	2372.68	95.00	92.50
2	1706.17	1844.55	90.00	87.50
3	1213.59	1331.42	77.50	75.00
5	1931.88	2068.72	97.50	85.00
7	1525.39	1760.77	100.00	82.50
8	1547.20	1491.17	60.00	77.50
9	1464.12	1610.60	97.50	85.00
11	1852.52	2077.50	97.50	92.50
12	1655.09	1934.14	100.00	82.50
13	1846.04	2107.01	92.50	87.50
14	1964.49	2171.17	95.00	92.50
15	1994.83	2114.91	85.00	70.00
16	1651.27	1693.50	100.00	55.00
18	1551.24	1708.59	95.00	87.50
19	1296.26	1467.71	92.50	92.50
21	1296.19	1521.51	100.00	87.50
22	1676.19	1816.60	97.50	72.50
23	1305.60	1313.89	97.50	77.50
24	1736.87	2049.68	92.50	80.00
25	1511.98	1532.66	90.00	75.00
26	1723.16	2020.81	100.00	82.50

Table 4. Older adults' individual mean response time and accuracy data for the sentence-to-word matching task.

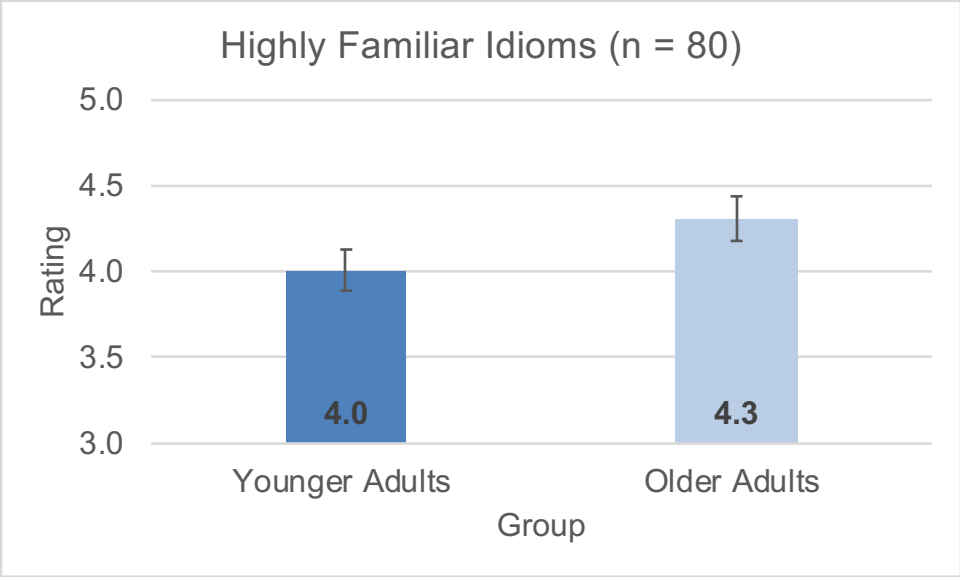
Participant	Idiomatically-biased Context Mean RT (ms)	Literally-biased Context Mean RT (ms)	Idiomatically-biased Context Mean Accuracy (% correct)	Literally-biased Context Mean Accuracy (% correct)
1	1701.51	1918.20	97.50	97.50
2	1997.56	2419.25	97.50	75.00
3	1523.18	1828.59	97.50	95.00
4	1806.25	2067.28	100.00	80.00
5	1966.11	2494.81	92.50	67.50
6	1892.07	2173.54	100.00	92.50
7	2177.90	2316.41	95.00	90.00
9	1521.70	1672.63	100.00	90.00
10	2044.87	2464.45	97.50	85.00

Familiarity Ratings Task

A 2 × 2 repeated-measures ANOVA with the within-subject factor of Familiarity (High vs. Low) and between-subject factor of Group (Young vs. Old) was conducted on the mean Likert scale ratings (1 = have never seen, heard or used the idiom, 5 = have very frequently seen, heard or used the idiom). Results showed a main effect of Group [$F(1, 28) = 10.90$, $p < .01$, $\eta_p^2 = 0.28$] indicating that older adults produced higher overall ratings than younger adults. There was also a main effect of Familiarity [$F(1, 28) = 325.39$, $p < .0001$, $\eta_p^2 = 0.92$] showing that across both groups, familiar idioms were rated higher than less familiar idioms. Finally, there was a Group × Familiarity [$F(1, 28) = 10.41$, $p < .01$, $\eta_p^2 = 0.27$] interaction demonstrating higher ratings for the older adults for all idioms, but the same pattern as the younger adults, that is higher ratings for familiar than less familiar idioms. Specifically, younger adults gave more familiar idioms a rating of 4.01/5 and less familiar idioms a rating of 2.24/5. Similarly, older adults gave more familiar idioms a rating of 4.31/5 and less familiar idioms a rating of 3.08/5. Both

groups also rated the highly familiar idioms with no less than a 3.5/5 (73/80 idioms for younger adults, and 76/80 idioms for older adults). In sum, it seems that younger and older adults were very familiar with the 80 idioms included in the sentence-to-word matching task. There were a few cases where familiar idioms were rated somewhat lower in each group. For the younger adults, these idioms were: *blow a fuse, know the score, say the word, show your teeth, take someone for a ride, blow the whistle,* and *climb the ladder*. For the older adults, these idioms included: *say the word, show your teeth, shut your trap,* and *climb the ladder*. Three of the idioms rated as somewhat less familiar are the same across the age groups. Mean ratings for each group are presented in Figure 7.

Figure 7. Average ratings for highly familiar idioms for each group.



IV. DISCUSSION

Across two different tasks, the present study investigated age-related differences in idiom comprehension as a function of familiarity and context. Due to inconsistent previous results in terms of older adults' ability to understand idioms, it was unclear how they would perform in a cognitively-demanding task which measured response time and accuracy. I predicted that if older adults were unable to comprehend idioms in a cognitively demanding task, then they would be slower to select the contextually appropriate meaning of the idiom in literally- and idiomatically-biased contexts. Younger adults were expected to demonstrate faster response times in selecting the meaning of the idiom in literally- and idiomatically-biased contexts. For the sentence-to-word matching task, both groups responded faster to the targets with idiomatically-biased contexts than to the targets with literally-biased contexts. For the familiarity rating task, older adults produced higher overall ratings, in that they gave a higher rating to both highly familiar and less familiar idioms compared to the younger adults. Both the younger adults and the older adults rated the highly familiar idioms as more familiar than the less familiar idioms. Overall, both groups were familiar with the 80 idioms presented in the sentence-to-word matching task. Based on these findings, older adults do not seem to experience any age-related decline in idiom comprehension.

Other studies have found similar results to what I found (Coane et al., 2014; Hung & Nippold, 2014; Qualls & Harris, 2003), however they had a different method and procedure. My findings do not support our original hypothesis that aging impacts idiom comprehension. It was originally hypothesized that the older adults would have a harder

time with the sentence-to-word matching task. The nature of this task was cognitively demanding because it was timed, such that the participants had only one chance to listen to the sentence and select their answer. This task proved not to be challenging for older adults, as they performed in a similar way as the younger adults. I also hypothesized that since all idioms had been previously normed for familiarity, they would be rated as highly familiar by both groups, which was supported by our results. Results of the familiarity ratings task show that both younger and older adults were very familiar with the previously normed highly familiar idioms. Finally, I predicted that individuals who can use context effectively will only activate contextually-appropriate meanings, which was supported by the results.

These results can help us better understand idiom comprehension models. The direct access hypothesis, a compositional model, argues that the literal interpretation of the idiom does not need to be computed. Given appropriate context, the intended meaning of the idiom can be understood directly (Gibbs, 1980, 1985). This hypothesis fits the current data best because the participants responded faster to the idiomatic sentences than the literal sentences. Hybrid models, such as the constraint-based hypothesis, propose that the literal interpretation is initially activated, then activation of the figurative meaning will increase over time depending on certain linguistic constraints, such as how familiar or predictable the idiomatic phrase is (Libben & Titone, 2008). If the literal meaning was initially activated, then the reaction time to the literal target after literally-biased sentences should have been faster than the reaction time to idiomatic targets after idiomatically-biased sentences, which was not the case, therefore this hypothesis does not align with the current results.

Context helps provide individuals with the information needed to decide whether an ambiguous idiom should be interpreted literally or figuratively (Holsinger, 2013). The context is supposed to guide the participant to select the contextually appropriate response, and this was in large part the case in the current study. Yet, some of the literally biased sentences were responded to incorrectly as the participants often choose the idiomatic target. This finding suggests that although the context aids in selecting the contextually appropriate meaning, there are still situations in which it cannot override the dominant figurative interpretation of ambiguous idioms.

One limitation of the current study is that we only tested nine older adults and 21 younger adults. This sample is very small relative to previous studies on idiom comprehension, so we are limited in our ability to generalize the results beyond the current study. Another limitation could be related to how the Apple Pencil and iPad were used in an unconventional way for the sentence-to-word matching task. Participants were asked to hold the pencil near the top, so that their hand would not block any of the words on the screen. This is not how an individual would normally use the pencil, so they required more time to become familiar with holding the Pencil in this way. With respect to future research, this study could also be tested on a variety of clinical populations, including people with aphasia, dementia, and other neurogenic disorders. Since some of these individuals have difficulty with motor control, the methodology would need to be adapted. My research shows that healthy older adults do not have difficulty comprehending idioms, however there are still open questions about whether or not individuals with neurogenic disorders are able to comprehend this type of figurative language.

V. CONCLUSION

The goal of the current study was to understand how aging impacts the ability to process ambiguous idioms and whether older adults are able to effectively use context during a cognitively demanding idiom comprehension task. Results of the sentence-to-word matching task showed that younger and older adults responded more quickly to idiomatic targets following idiomatically-biased contexts than to literal targets following literally-biased contexts. Both groups were also more accurate for idiomatic targets following idiomatically-biased contexts than for literal targets following literally-biased contexts. Results of the familiarity ratings task further showed that both younger and older adults gave higher ratings to highly familiar idioms than less familiar idioms, arguing that the idioms were very familiar to all participants. In conclusion, the current results demonstrate that older adults do not have difficulty comprehending idioms. They also argue that older adults are able to effectively use context to determine the appropriate interpretation of an ambiguous idiom.

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APPENDICES

APPENDIX A

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

PRINCIPAL INVESTIGATOR: Amy de Silva — **EMAIL:** amy.de@maine.edu
CO-INVESTIGATOR: — **EMAIL:**
CO-INVESTIGATOR: — **EMAIL:**
FACULTY SPONSOR: Christopher Grindrod — **EMAIL:** christopher.grindrod@maine.edu
(Required if PI is a student):
TITLE OF PROJECT: Context effects on ambiguous idiom comprehension in older and younger adults

START DATE: 2/26/18 **PI DEPARTMENT:** Communication Sciences and Disorders
FUNDING AGENCY (if any):

STATUS OF PI: UNDERGRADUATE

1. If PI is a student, is this research to be performed:

- ☒ for an honors thesis/senior thesis/capstone?
- ☐ for a doctoral dissertation?
- ☐ other (specify)
- ☐ for a master's thesis?
- ☐ for a course project?

2. Does this application modify a previously approved project? NO. If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? YES

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: If the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

****

FOR IRB USE ONLY **Application # 2018-01-15** **Review (F/E): E Expedited Category:**
ACTION TAKEN:

- X☐ **Judged Exempt; category 2 Modifications required? Yes Accepted (date) 2/21/2018**
- ☐ **Approved as submitted. Date of next review: by Degree of Risk:**
- ☐ **Approved pending modifications. Date of next review: by Degree of Risk:**
  Modifications accepted (date):
- ☐ **Not approved (see attached statement)**
- ☐ **Judged not research with human subjects**

FINAL APPROVAL TO BEGIN **2/21/2018**
Date

01/2017

APPENDIX B

Consent Form: Older Adults

Research Project: Figurative language comprehension in older and younger adults

Principal Investigator: Amy de Silva, Undergraduate Student, Department of Communication Sciences and Disorders

Co-Investigator: Christopher M. Grindrod, PhD, Assistant Professor, Department of Communication Sciences and Disorders

Purpose:

You are being asked to participate in a research project conducted by the above-named individuals. The purpose of this study is to investigate older adult's ability to comprehend figurative language. You must be between the ages of 55-85 to participate in this study.

What will you be asked to do?

This study will take place in 1 session lasting 1 hour. This study will take place in the Neurolinguistics Lab at The University of Maine Orono campus. You will be asked to complete the following tasks:

Sentence to Word Matching:

You will be asked to listen to sentences and four words will appear on an iPad screen. You will choose one word that best matches the meaning of the sentence by tapping that word on the iPad. There will be four answers, and your job is to select the answer that bests matches the sentence you just heard.

Familiarity Task:

You will be asked to rate how familiar you are with the phrases that you previously heard. You will be presented with a phrase on an iPad and asked to choose on a scale of 1-5, where 1 is never and 5 is frequently, how often you have encountered this phrase.

Risks to Participants:

Minor risks are time commitment and mental fatigue.

Benefits:

Although there are no direct benefits to you as the participant, this study will increase our understanding of figurative language comprehension in older and younger adults. Carrying out this project may also allow clinicians to develop more technologically based and up-to-date treatment methods for people who have difficulty comprehending figurative language.

Compensation:

You will be paid $10 an hour for participating in this study. If you do not complete the study for any reason, you will be paid for the partial time completed ($2.50/15 minutes).

Confidentiality:

Your participation and performance in this study will remain confidential and at no time will published results refer to you specifically by name. Your name will not be included in any of the data. A code will be used to protect your identity. All data will be kept in a secure location in the co-investigator's locked research lab. Only research personnel directly associated with the project will have access to the data. All data will be kept until December 31, 2020. The data will be kept on a secure computer in the co-investigator's locked research lab.

Voluntary:

Your participation is completely voluntary. You are free to withdraw at any time and you will receive partial compensation for completing a portion of the study. In no way will the acceptance or refusal to participate in this study affect your present or future treatment.

Contact Information:

If you have any questions about this study, you may contact Amy de Silva (207-581-2015; amy.de@maine.edu) or Dr. Christopher Grindrod ((207-581-2014; christopher.grindrod@maine.edu). If you have any questions about your right as a research participant, you may contact Gayle Jones, Assistant to The University of Maine's Protection of Human Subjects Review Board (207-581-1498; umric@maine.edu).

Statement of Consent:

Checking the box below indicates that you have read and understand the above information and agree to participate. You will be given a copy of this form.

By checking the box below, I agree to participate in this study.

☐

_____

Date

Consent Form: Younger Adults

Research Project: Figurative language comprehension in older and younger adults

Principal Investigator: Amy de Silva, Undergraduate Student, Department of Communication Sciences and Disorders

Co-Investigator: Christopher M. Grindrod, PhD, Assistant Professor, Department of Communication Sciences and Disorders

Purpose:

You are being asked to participate in a research project conducted by the above-named individuals. The purpose of this study is to investigate younger adult's ability to comprehend figurative language. You must be between the ages of 18-30 to participate in this study.

What will you be asked to do?

This study will take place in 1 session lasting 1 hour. This study will take place in the Neurolinguistics Lab at The University of Maine Orono campus. You will be asked to complete the following tasks:

Sentence to Word Matching:

You will be asked to listen to sentences and four words will appear on an iPad screen. You will choose one word that best matches the meaning of the sentence by tapping that word on the iPad. There will be four answers, and your job is to select the answer that bests matches the sentence you just heard.

Familiarity Task:

You will be asked to rate how familiar you are with the phrases that you previously heard. You will be presented with a phrase on an iPad and asked to choose on a scale of 1-5, where 1 is never and 5 is frequently, how often you have encountered this phrase.

Risks to Participants:

Minor risks are time commitment and mental fatigue.

Benefits:

Although there are no direct benefits to you as the participant, this study will increase our understanding of figurative language comprehension in older and younger adults. Carrying out this project may allow clinicians to develop more technologically based and up-to-date treatment methods for people who have difficulty comprehending figurative language.

Compensation:

You will be paid $10 an hour for participating in this study. If you do not complete the study for any reason, you will be paid for the partial time completed ($2.50/15 minutes).

Confidentiality:

Your participation and performance in this study will remain confidential and at no time will published results refer to you specifically by name. Your name will not be included in any of the data. A code will be used to protect your identity. All data will be kept in a secure location in the co-investigator's locked research lab. Only research personnel directly associated with the project will have access to the data. All data will be kept until December 31, 2020. The data will be kept on a secure computer in the co-investigator's locked research lab.

Voluntary:

Your participation is completely voluntary. You are free to withdraw at any time and you will receive partial compensation for completing a portion of the study. In no way will the acceptance or refusal to participate in this study affect your present or future treatment.

Contact Information:

If you have any questions about this study, you may contact Amy de Silva (207-581-2015; amy.de@maine.edu) or Dr. Christopher Grindrod (207-581-2014; christopher.grindrod@maine.edu). If you have any questions about your right as a

research participant, you may contact Gayle Jones, Assistant to The University of Maine's Protection of Human Subjects Review Board (207-581-1498; umric@maine.edu).

Statement of Consent:

Checking the box below indicates that you have read and understand the above information and agree to participate. You will be given a copy of this form.

By checking the box below, I agree to participate in this study.

☐

_____

Date

AUTHOR'S BIOGRAPHY

Amy de Silva was born in Dartmouth, Massachusetts and raised by her parents Catherine and William Sr. alongside her younger brother William Jr. After graduating from Dartmouth High School with Honors, Amy committed to attending the University of Maine with a major in Communication Sciences and Disorders. During her time at UMaine, Amy was involved in many clubs and organizations. Amy was a member of Best Buddies since her Freshmen year, and served as the Event Coordinator her Sophomore through Senior year. Amy was also a proud sister of Chi Omega for four years, and during her time served as the Director of Chapter Events, Facility Manager, and two-term President. She was also a member of several Honors Societies including Alpha Lambda Delta and Order of Omega, in which she also served as the event coordinator. Amy loves community service, and was a member of the Marketing Team for UMaine's Dance Marathon, as well as a volunteer for the Special Olympics and World Language Day at the University. During her Senior Year, Amy worked as a Research Assistant in the Neurolinguistics and Aphasia Research Lab under the supervision of Dr. Christopher Grindrod. Finally, Amy was honored with the opportunity to represent women across campus by being the Public Relations Chair and Historian for the All Maine Women Class of 2018.